

## **What is claimed is:**

- [Claim 1]**      1. An antenna, comprising:  
a central core, having a central coupling region ;  
one or two pairs of radiating antenna lines, formed a surface of the central core; and  
a balun transformer, formed on a circuit board and electrically coupled to the pair of radiating antenna lines,  
wherein the circuit board has a protruding structure to affixing into the central coupling region of the central core, wherein a signal input/output (I/O) end of the antenna is at another end of the balun transformer.
- [Claim 2]**      2. The antenna of claim 1, wherein the central core includes a dielectric rod.
- [Claim 3]**      3. The antenna of claim 1, wherein the two pairs of radiating antenna lines form a quadrifilar helix antenna (QHA).
- [Claim 4]**      4. The antenna of claim 1, wherein the one pair of radiating antenna lines forms a bifilar helix antenna (BHA).
- [Claim 5]**      5. The antenna of claim 1, wherein the pair of radiating antenna lines includes a meander structure or a line-width adjusting structure at a location, at which a current is minimal.
- [Claim 6]**      6. The antenna of claim 1, wherein the pair of radiating antenna lines includes a meander structure or a line-width adjusting structure at a central region of each of the helix antenna lines.
- [Claim 7]**      7. The antenna of claim 1, wherein the balun transformer includes two paths, and each of the paths includes a capacitor and an inductor, so that a desired equivalent length for each of the paths is obtained.
- [Claim 8]**      8. The antenna of claim 7, wherein one of the two paths has an equivalent one-quarter wavelength and another one of the two paths has an equivalent three-quarter wavelength.

- [Claim 9]            9. The antenna of claim 7, wherein the two paths of the balun transformer are formed on a same side of the circuit board.
- [Claim 10]           10. The antenna of claim 7, wherein the two paths of the balun transformer are formed on different side of the circuit board.
- [Claim 11]           11. The antenna of claim 1, wherein the central coupling region of the central core has a hole with a groove, so as to adapt the protruding structure of the circuit board.
- [Claim 12]           12. A balun structure, suitable for use in electrical coupling to an antenna radiating part, the balun structure comprising:
- a circuit board;
  - a first path on the circuit board, including a circuit formed from a capacitor and an inductor, so as to have a first equivalent length with respect to an operating wavelength; and
  - a second path on the circuit board, including a circuit formed from a capacitor and an inductor, so as to have a second equivalent length with respect to the operating wavelength, wherein an equivalent length difference between the first and the second paths is half wavelength,
- wherein the first path and the second path have a commonly connected node for serving as a signal input/output (I/O) end.
- [Claim 13]           13. The balun structure of claim 12, wherein the first wavelength path and the second wavelength path are on the circuit board on a same side or on different sides of the circuit board.
- [Claim 14]           14. The balun structure of claim 12, wherein the balun structure is also used to match impedances between a 50-ohm signal line and an input impedance of the antenna radiating part.
- [Claim 15]           15. The balun structure of claim 12, wherein the inductor for each of the two paths is a metal line.

**[Claim 16]**                16. A wireless communication apparatus,  
                                 comprising:

a main functional unit; and

an antenna as recited in claim 1, for transmitting and receiving radio-frequency (RF) signals.

**[Claim 17]**                17. The wireless communication apparatus of claim  
                                 16, wherein the pair of radiating antenna lines includes a meander  
                                 structure or a line-width adjusting structure at a location, at which a  
                                 current is minimal.

**[Claim 18]**                18. The wireless communication apparatus of claim  
                                 16, comprising a mobile phone.

**[Claim 19]**                19. The wireless communication apparatus of claim  
                                 16, wherein the balun transformer includes two paths, and each of  
                                 the paths includes a capacitor and an inductor, so that a desired  
                                 equivalent length for each of the two paths is obtained.

**[Claim 20]**                20. The wireless communication apparatus of claim  
                                 19, wherein the two paths have an equivalent length difference by  
                                 half wavelength.